SOME OBSERVATIONS ON THE TROUT FARM AND HATCHERY AT ACHHABAL, KASHMIR

BY

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The Trout Farm and Hatchery at Achhabal were started in 1906-1907 and adjoin the Mogul Gardens. They are thus a great attraction for thousands of visitors and tourists. Unlike two other trout farms and hatcheries at Harwan and Laribal, the water supply at Achhabal is from a flowing spring directly to the farm without any protective works. No precaution is thus taken to prevent trash and debris from being carried into the water supply line. Though normally the water is only slightly turbid, at times it becomes muddy also. The observations recorded here were made during two short stays at the farm during June 1954 and July 1955. I am grateful to the authorities for supplying the data and to Mr. G. M. Malik, Director, Fish Preservation Department, Jammu and Kashmir State, for going through the article and offering comments.

STOCK POSITION

Both Rainbow and Brown trout are kept at the farm of sizes varying from 2 oz. to 5 lbs. The stock position during the last six years was as follows:

Year		1949–50	1950–51	1951–52	1952–53	1953–54	1954–55
Rainbow	...	485	586	509	442	393	410
Brown	...	2,552	2,520	2,252	2,227	1,958	1,907
Total	...	3,037	3,106	2,761	2,669	2,356	2,317

The quantities of trout sold from this hatchery for the same period are given below:

Year		1949–50	1950–51	1951–52	1952–53	1955–54	1954–55
Rainbow	...	4	5	10	3	5	14
Brown	...	94	161	165	202	109	119
Total	...	98	166	175	205	114	133

Year		1949–50	1950–51	1951–52	1952–53	1953–54	1954–55
Weight	...	484 lb. 14 oz.	795 lb. 9 oz.	844 lb. 8 oz.	836 lb. 12 oz.	415 lb. 7 oz.	487 lb. 4 oz.
Amount realised.	Rs.	749-7-3	1,278-3-3	1,302-4-3	1,521-8-0	964-14-6	1,507-8-0

The quantity of diseased fish of different sizes that had to be destroyed during the same period was as follows:

Year	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55
Rainbow ...	53	94	67	64	59	72
Brown ...	294	171	272	223	188	179
Total ...	347	265	339	287	247	251

Calculating the mortality figures against the stocks in the corresponding years we get the following percentage of mortality for each kind:

Year	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55
Rainbow ...	11.0	16.0	13.1	14.5	15.0	17.5
Brown ...	11.5	6.7	12.0	10.0	9.6	9.4

It will be seen from the above statement that the rate of mortality is generally higher in the case of Rainbow than that of Brown trout.

Besides the sale of trout, which is insignificant, the main function of this hatchery seems to be the stocking of trout streams with eyed ova and fingerlings. The figures in this respect for the last 6 years are as follows:

Year	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55
Eyed Ova ...	1,50,000	1,50,000	1,50,000	1,00,000	2,50,000	1,95,000
Fingerlings ...	3,237	3,310	1,328	4,177	2,340	3,500

In 1954-55, a total number of 481,000 eggs were obtained. Of this number, 247,000 became 'eyed', while the others had to be thrown away, thus showing a survival 51·3%. This survival rate seems to be good when it is learned that old antiquated hatchery methods are followed. The eggs once laid in trays are not touched and even the dead eggs are not picked and removed out, thus allowing fungus to take a full toll of the healthy eggs.[1]

In 1954-55, 72,000 eyed ova were retained in the hatchery for cultural purposes and the fingerlings developed out of them will be counted at the time of next breeding season.

Diseases and other Causes of Mortality

In 1939, Malik[2] reported on an epidemic among Rainbow trout in the Harwan Hatchery during 1934 and also made some observations on certain other cases of mortality in that hatchery. He attributed

[1] Mr. G. M. Malik informs me that 'In Kashmir daily removal of dead eggs before eyeing used to cause more loss than removal of dead eggs after eyeing. The practice therefore continues and no dead eggs are removed till the eyes appear when the ova can withstand disturbance or shocks'.

[2] Mr. G. M. Malik informs me that the records of diseases should be taken with caution as they are kept by semi-literate persons without making any *post-mortem* examination of the dead specimens.

the epidemic to lipoid and fatty degeneration of the liver through feeding the fish on fatty fresh-fish diet. He observed[1]:

'Normally the disease would have never occurred in the form of an epidemic but it was accentuated owing to unfavourable conditions that prevailed for several months preceding the epidemic. These were —shortage of water, insanitary conditions of the pens and over-crowding that resulted in abrasions, and subsequent attack by fungus. The malady was further aggravated by the breeding season when the vitality of the fish is naturally reduced as the epidemic was noticed just at the close of the breeding season.'

Of the 251 fishes that died in the Achhabal Farm during 1954-55, the following is the analysis of the causes of death as recorded in the Mortality Register by the Jamadar of the hatchery:

Fungus (white patches)	182
Lipoid degeneration of the liver ...	22
Blindness	17
Injuries through otters	14
Spawn-bound	9
Muddy water	4
Fin rot	3

It will be worthwhile to examine the causes of these diseases against the layout of the Farm and the cultural practices that are followed.

Fungus Infection: Though all freshwater fishes of various ages are liable to be attacked by the fungi or water-moulds (Saprolegniaceae), it is doubtful whether the fungus is the primary cause of the trouble. The fungus attacks only when it can obtain a foothold on an injured part of a fish—physical injury or that caused by external parasite. Susceptibility to infection is greatly increased if the fishes are suffering from general debility or are living under unfavourable conditions. Eggs are also subject to attack by the fungus and in most hatcheries the heaviest losses are in the egg stage.

The heaviest loss of adult fish occurs after stripping, in the months of December and January. In tank No. 19, where males and females of Brown Trout are kept for stripping, 17 males and 10 females died from fungus infection. The loss to the hatchery through stripping operations was about 200 lb. of trout from various tanks. In the handling of fish incidental to stripping, it is almost impossible to avoid injuring some of the fish slightly. As at the spawning season the vitality of the fish is usually lower, they are especially susceptible to infection by the fungus. According to Davis (1953, p. 279), 'fungus infection can often be prevented from developing in spawned fish by dipping them in a 1:15,000 solution of malachite green, or in a 3 per cent salt solution after they have been stripped.' They should be kept in the solution until they show signs of distress.

After stripping, the practice at this hatchery is to return the fish to the same tank which is usually crowded with other fish. I would suggest that they should be put in a special tank where greater care could be taken of them for a few days until they regain strength and

[1] Malik, G. M., *Journ. Bombay Nat. Hist. Soc.*, 41: (2) 397-408, 1939.

vigour. Sometimes fish, particularly Rainbow Trout, bite off portions of caudal fin of other fishes and the injury thus produced gives a foot-hold to the fungus.

At other periods also fungus infection accounts for a large number of deaths mostly among the yearlings, but the bigger fish are not immune from it. If the infection is detected in the early stages of the disease, one such treatment as indicated above is usually effective, but if the fungus is well established, even several successive treatments may not effect a cure. It is, therefore, most essential to prevent the development of disease.

I have already referred above to a loss of nearly 44% of ova, probably through the fungus infection, and suggested that dead ova should be picked out and removed as soon as detected. For still better results reference may be made to Davis (1953, pp. 280-281).

Lipoid Degeneration of the Liver: This disease is caused by malnutrition resulting from overfeeding or the use of unsuitable diets. At the Achhabal Hatchery fishes of over a pound in weight are fed on small pieces of country fish freshly collected each day from certain reserve streams. Few fishes of over a pound in weight die from this disease during the months May-June to August-September. During these months three Schizothoracine fishes, Khout (*Oreinus plagiostomus*), Zoobo and Kontgad or Choozge (*Schizothorax* spp.), run up the streams for breeding and are full of mature gonads. It is known that roe of these fish cause intestinal trouble in man (Annandale 1920, *Rec. Ind. Mus.*, xviii, p. 192). It is likely that some fish overfeed during that period and suffer from lipoid degeneration of the liver.

Some yearlings fed on dry meals, consisting of silkworm pupae and fish, have also suffered from this disease. These meals are concentrated fatty food and there are, therefore, more chances of getting a fatty liver when on this diet.

On the first appearance of the disease, it is better to isolate the fish and control its feeding till it fully recovers. Unfortunately, there is no serviceable isolation tank in the hatchery at present so it would seem difficult to save such fishes from death.

Blindness: Out of 17 cases, 8 occurred during August-September and most of the diseased fish were taken out from tank No. 12. I have found a large number of the *Lymnaea* snails in the hatchery tanks and have therefore presumed that the blindness may have been caused by the Eye Fluke (Strigeidae). The metacercariae of this fluke occur only in the lens of the eye and when abundant cause it to become white and opaque, so that the fish becomes partially or totally blind. For the control of this disease, the best thing will be to eliminate snails from the pond by first draining the pond, removing plants, and then the sides and bottom should be thoroughly cleaned and chlorinated to kill the hiding snails.

Depradation by Otters: Otters entered tank No. 16 from the spring side one night during October-November and injured several fish of which 14 died on subsequent days. On an inspection of the site it seems a proper fencing of the farm on the spring side may prevent such losses in future years.

Spawn-bound: Some female fish are unable to liberate their eggs and therefore die spawn-bound. There seems to be no remedy for it. Mr. G. M. Malik is of the opinion that spawn-bound condition is associated with high calcium content of the water, high temperature and accumulation of fat in the viscera.

Muddy Water: Though only 4 cases of death through muddy water have been registered, I am informed heavy mortality among fry, which are kept separately from the main stock, occurs as a result of the muddy water. The tank bottoms get covered with silt and these are cleaned only once a year. It will greatly improve the sanitation of the farm if a settling tank could be put up at the head of the stream feeding the farm and hatchery channels[1]. It may also help to check the fungus and liver diseases.

Fin Rot: This is a bacterial infection which usually first appears in the dorsal fin but may occasionally start in the caudal fin. It is noticeable as a distinct white line along the outer margin of the fin and then moves inwards and destroys the whole fin. This can be controlled by dipping the fish for one or two minutes in a 1:2,000 solution of copper sulphate. This is good treatment in the early stages of the disease. Several treatments at intervals of 24 hours are required before the spread of the disease can be effectively checked. If the fish is in an advanced stage of infection, it should be taken out and destroyed to save other fishes from getting infected.

Food and Growth

Up to a weight of 12 oz., the trout are fed on dried silkworm pupae and fish powdered to various grades of fineness for feeding young of different sizes. In Tank No. 12, 138 fish of 12 oz. to $1\frac{1}{4}$ lb. are kept on a mixed diet of silkworm pupae and small pieces of fresh country fish about a seer in weight. In Tank No. 15, 182 fish of 12 oz. to $1\frac{1}{4}$ lb. are fed on fresh fish about $1\frac{1}{2}$ seers in weight once a day. In Tank No. 16, 176 fish of 14 oz. to $1\frac{1}{2}$ lb. in weight are given about 2 seers of fish. In Tank No. 17, 210 fish of $1\frac{1}{2}$ lb. to $2\frac{1}{2}$ lb. are given 4 seers of country fish. Seventy-six fish in Tank No. 18 of 3 to 6 lb. in weight are given 4 seers of country fish, while 198 fish of 2 to 3 lb. in Tank No. 19 are given 5 seers. In Tank No. 20, 64 fish of 2 to 3 lb. are given 2 seers of country fish while 8 trout of $2\frac{1}{2}$ to $3\frac{1}{4}$ lb. in Tank No. 20B are given half a seer. These figures are all approximate as the person who feeds the fish takes handfuls of chopped country fish from a bucket when feeding fish in each tank. The amount thrown in each tank cannot be accurate and it cannot be stated whether or not each fish had a feed.

[1] Mr. G. M. Malik informs me that 'Plans for setting up a filtration system have already been approved and it is hoped that sedimentation troughs for hatcheries will be constructed next year'.

Three or two fishermen, according to seasons of scarcity or abundance of country fish in the reserve streams, are employed for catching local fish and naturally the quantity procured by them varies from day to day. Accordingly the ration of food given to fishes also varies. From the data collected by me for some other investigation, it appears that approximately 16 seers of country fish is brought to the hatchery daily by three fishermen from the middle of June to the middle of November, thus the ration for each tank given above is reduced to 4/5 for these months. From the middle of November to the end of March, only 2 fishermen are employed but they bring in an average of 22 seers every day. From the first of April, a third fisherman is employed and the quantity brought in increases to 26 seers on an average up to middle of May.

This system of feeding has one obvious defect. During the summer months when the fish are generally more active, the supply of food is less. When the food supply increases in winter, the fish are not so active and overfeeding may result in the lipoid degeneration of liver. It will be seen from the above that heaviest mortality occurs among the adult fish in December and January from fungus infection after stripping and this reduces the stock to be fed when the supply is abundant.

From what is stated above, it would seem highly desirable that the system of feeding should be rationalised for the health and proper growth of the fish. During winter months when Rapat, *Labeo diplostomus* (Heckel), is plentiful even in farm and hatchery streams, efforts should be made to collect large quantities and dry them up in a small drier to be used during the months of scarcity of food. This proposal involves only a small outlay but ensures equitable food supply throughout the year.

Feeding of trout with fish of the coarser and cheaper grades has certain disadvantages as pointed out by Davis[1] (p. 77). He says:

'Fresh fish of the coarser and cheaper grades have been used rather extensively for trout foods, but the results have not been entirely satisfactory. It usually requires about twice as much fish as meat to produce an equal growth. . . As already pointed out, the use of fish in trout diets frequently results in a vitamin B_1 deficiency, which may have disastrous results. If this is guarded against, fish may be safely included in the diet. In general, however, it is believed that the percentage of fish should not be higher than 20 to 25 per cent.'

The deficiency of thiamin, source of vitamin B_1, results from fish diet for there is some substance in the tissues of the fish which destroys vitamin B_1 on contact (Davis, p. 73). Loss of balance results from this disease at first occasionally but in course of time it develops into a complete inability to maintain a normal position, although the fish may live for weeks in this condition. To correct B_1 deficiency, wheat products, such as middlings, and livers are the best sources of thiamin. The plant meals are also stated to be fair sources of this vitamin.

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[1] Davis, H. S., 1953—*Culture and Diseases of Game Fishes,* University of California Press, Berkeley and Los Angeles.

Up to 3 years, the growth of trout is stated to be very slow, for during this period it only attains a weight of 14 oz. to 1 lb. After the third year, the growth may be a pound a year, for a 5 year fish may be 3 lb. in weight. How far this growth rate is associated with food supplied to the fish below 12 to 14 oz. and to those over a pound is difficult for me to say, but it is evident that a pound of trout costs several times more to the Government than the so-called exorbitant price of Rs. 3 per pound at which it is sold from the hatcheries. No commercial concern could possibly maintain a trout farm on this basis and it is necessary, therefore, that the working of these farms be reviewed and brought in line with modern developments and techniques, so as to make them a source of revenue and encouragement for private enterprise.

Conclusions and Recommendations

In view of what is stated above, it would be clear that some drastic changes in the layout and management of the Farm and Hatchery are called for. In the layout, sanitation of the premises and ponds should receive early consideration. A boundary wall, a small concrete reservoir at the spring, a good settling tank and filter beds for the hatchery, thinning of stocks with the building of more ponds among other measures are necessary to improve sanitation. An analysis of the spring water, analysis of the food values of country fish, ecology and biology of the fauna and flora of the trout ponds and channels are some of the basic scientific problems that need attention. The rational feeding of the fish, both qualitatively and quantitatively, is of the utmost importance. The practices of stripping, care of eggs and fingerlings should be modernised. In view of natural reproduction in the streams, the practice of stocking streams with eyed ova should be examined. There is need to produce more trout to meet tourist demand and I feel sure that the existing farms with suitable improvements can do the job.